In the colony of Victoria cooking and warming by gas has great claims to our attention for several reasons, that, though important here, are of less consequence at home and in other countries. I refer to the sudden change of temperature, often varying as much as thirty degrees Fahrenheit in a few hours, and also to the fact that in no part of the world does the saying of "time is money" admit of a broader or more truthful application than here.

The public of Great Britain have been much indebted to J. O. N. Rutter, Esq., for many excellent hints on the use and abuse of gas; and in a paper read before the Society of Arts, in 1853, he proceeds to say,—"It may not be immediately and not without its advantages in promoting the sale of gas, if its applicability to heating purposes be a little more attentively considered, the proper methods of using gas need only to be understood to become popular. The actual and relative cost of such is not of so much importance as may be imagined. In the every day business of life, out of doors and in-doors, we willingly pay something extra for comforts, conveniences, and luxuries; so it is with gas as fuel, the most simple, comfortable, and healthful means of adopting it ought to be the first consideration, if it cost more than a common fire as a matter of £ s. d., it possesses advantages of another kind which money will not easily purchase."

Mr. Chairman and Gentlemen, understanding that other papers will claim your attention this evening, I draw this paper somewhat abruptly to a conclusion, at its commencement I stated that I would refer to, and quote from, various authorities on the subject, I have done so; and lest I should be accused of plagiarism, I beg again to acknowledge the fact.

I have to thank you for your attention to a Light subject although it may have been rather Heavily treated.

XVII.

KEILOR BRIDGE.

BY EDWARD RICHARDSON.

READ JUNE 7, 1855.

In this colony, as in all other new countries, particular attention has been paid to the formation of roads and bridges, the latter requiring in many instances much skill and ingenuity.

Timber bridges, in the natural order of things, seem to be the first; they may be found in many rural districts where science in these matters is unknown.

For instance, it is but natural to place two logs across a stream of small dimensions, and on these logs place transverse timbers, and then a crossing is obtained.

The subject of the present paper is one of these instances, two of these rusticated bridges have been erected over the stream of the Keilor River, but the issue is too well known to repeat here, not only waste of labour, money, but loss of valuable lives.

Keilor is ten miles from Melbourne, situate on the main road to the Gold Fields. The Salt Water River rises here in floods to thirty feet or more above the bed of the river.

About two years and a half ago the traffic on that road exceeded that of any road in England, and yet no provision was made for a crossing, several old structures being washed away.

The present bridge was designed according to the requirements of the site, being built on an American principle, there

called Howe's Patent. The length of the bridge is 160 feet, its span 135 feet; it consists of two abutments of solid masonry, 38 feet high, the outside courses being hammered and dressed, and the hearting of rubble masonry. The superstructure of the bridge consists of three trusses placed on these abutments, the floor resting on the lower stringer of these trusses; it has two road-ways, each 10 feet 6 inches wide.

At the time the plans of this bridge were sent to the Lieutenant-Governor, Mr. Latrobe, there were only two contractors in Melbourne considered competent to undertake the work, one of these being the successful tenderer; the bridge was undertaken with the sanction of the Executive Council in March, 1853.

The contractor, Mr. Thomas Oldham, proceeded with the works as far as the masonry was concerned till the eve of its completion. The framing of the first truss was also completed, and I must say not without many difficulties. The terms of the contract left the whole of the responsibility with the contractor, as far as the erection and carrying out of the works as per plan and specification. The contractor, being a gentleman of great practical attainments, undertook to build the trusses according to his views, although repeatedly advised by the engineer to the contrary. The trusses were first framed on the ground and then set on edge, and latterly launched across the stream on edge.

This was an undertaking of no small mechanical skill, and is worthy of the man who projected the plan. A truss 17 feet high, 50 tons weight, and 160 feet long, to be removed across a chasm 100 feet, even with English means, would be considered no mean undertaking, and I am happy to say has been here performed successfully, but at the same time with a sacrifice to the contractor. The first truss was carried across without any accident or obstruction except that of enormous expense. It may be well here to describe the way

in which the truss has been raised on edge, canted and launched across the stream.

In raising the first truss recourse was had to wedges, these were entered at equal distances throughout the whole length of the truss; great care was taken to drive them simultaneously so that the truss might be raised equally from end to end, the truss was blocked up as so raised, subsequently jack-screws were used, and when nearly upright guy-ropes were attached to the top stringer, in order to keep it in its proper position when up, to these guy-ropes crab winches were applied, and by this means the raising was completed. The second truss was raised about four feet from the ground by means of jack-screws, and the remainder by four sets of shears, this plan being adopted as more secure and expeditious.

Owing to the nature of the ground, the position in which the trusses were built caused them when raised to stand at an angle of sixty degrees to the axis of the bridge, this involved a new difficulty, and three sets of "slides" or "ways" had to be laid something similar to those used in launching vessels; on the first of these the truss was moved endways about thirty-five feet; on the second about twenty; and on the third, which was nearly parallel to the axis of the bridge, about forty feet; the overhanging end was here landed on a stage built for the purpose, and the truss moved on its full length across the stream; owing to the inclination obliged to be given to the slides, the lower end was from twelve to fourteen feet below the top of the stone pier, and recourse was had to shears and powerful blocks and tackle, to lift the truss to its final resting place.

The second truss was more expeditiously raised; by the suggestions of the engineer, instead of raising the truss by screw-jacks entirely, four crab winches were provided, and shear legs to correspond, to which were attached blocks and tackle, the four crabs working simultaneously; the second truss was raised on edge, but in launching the truss lost its balance, and that portion of the structure fell to pieces.

The case being one of great difficulty the Government allowed the contractor to proceed with the work until this truss was rebuilt and carried over, on the condition that the resident engineer was responsible for the completion of the work. This being the first time the engineer was allowed to interfere with the arrangements or mode of carrying on the works.

It may not be out of place, that the engineer, Mr. George Holmes, previously expressed his dissatisfaction as to the plans proposed for erecting the bridge, his own notion being to erect a temporary pile scaffolding, and on that to erect the truss, but, as matters then stood, and taking the position of the broken truss, it was thought advisable to conform to the contractor's views and assist him—suffice it to say, the second truss was launched safely and placed in its position without accident.

The third truss was, by my own instructions, built on a platform resting on the two trusses previously carried across, and in one-third of the time and expense taken to place either the others in its position, which evidently proves the suggestion of the engineer in the first instance, that is, to build the bridge on a platform.

There are several bridges of a similar design now on American railways, ranging in span from 100 to 250 feet, where the span exceeds 150 feet a lamenated arch is generally introduced to assist in taking the weight off the middle of the truss, and transferring it to the branches, or eventually to the abutments of the arch.

The design of this bridge has been found to answer very well in America and in many places in Great Britain. The truss is simple and of great strength, no skilful mechanician is required, and the village carpenter of any country district may, if needs be, construct a similar bridge.

The lattice bridge had been in vogue for a long time in America, these seem to have given way to Howe's truss on

analysation and on its merit. The strength of Howe's truss is not interfered with by inferior mechanism so much as the others, and its means of adjustment vastly superior and more simple. Due inspection of the plan which is exhibited, will show some points which are evident to every one, as being simple and efficacious; the principle one of these is the tension or suspending rods, which are capable of adjusting the truss from the effects of the atmosphere, this may appear not worthy of particular notice, but in this colony it is of paramount importance, especially where colonial timber is used.

As to the strength of the truss, it may be easily obtained by a simple formula, but yet calculations are not always to be depended upon, the workmanship has to be looked after, and, from time to time, a suggestion and particular attention to details is often of more importance in the stability of a structure than is generally considered; as an instance, a design by the engineer, of a clamp was introduced, which proved its efficacy in the broken truss, the truss was broken in three places, but in no instance where a joining of beams took place did the clamp give way.

In calculating the dimensions of the various timbers in this bridge, a liberal allowance was made for defects in workmanship.

It may now safely be said, it has fully sustained its expectations, for I have myself oftentimes watched it, and could not at any time find any sensible deflection and very little vibration; finally, my firm belief is, if this bridge were enclosed and weather-boarded, it would last thirty years; the cost of the bridge 160 feet long, having two stone abutments thirty-eight feet high, above ordinary water level, was £11,000. Taking into consideration the time this bridge was built, when mechanics had 35s. per diem, and labourers from 12s. to 18s., it will bear a comparison with most of similar constructions, in Europe and America, in point of expense and workmanship.